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IS 6664 (1992): Micro-cellular rubber soles and heels [CHD 19: Footwear]

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(पहला पुनरीक्षण)

Indian Standard

RUBBER MICROCELLULAR SHEETS FOR SOLES AND HEELS — SPECIFICATION

(First Revision)

UDC 685·312·122·6 + 685·312·133

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

December 1992 **Price Group 4**

Footwear Sectional Committee, CHD 019

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Footwear Sectional Committee had been approved by the Chemical Division Council.

Rubber microcellular sheets are used in manufacture as well as repair of soles and heels of footwear, made by stuck on process. The design aspect of sheet and composition of rubber compound has been kept out of the scope of this standard and only the essential physical requirements have been prescribed.

This standard was originally published in 1972. Since then Amendment No. 1 was issued to this standard in 1984, which has been incorporated while revising the standard. In this revision, the title has been modified in order to truly represent the product for which the specification is meant. Further keeping in view the popular trade practice, hardness of the product has been expressed in Shore A Durometer, alongwith its method of determination. The test method for relative density, change in hardness after ageing at 100 ± 1°C for 24 hours and split tear strength have also been modified. The requirement for room temperature shrinkage has been introduced and Type 2 of the product has been excluded in this standard.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

RUBBER MICROCELLULAR SHEETS FOR SOLES AND HEELS — SPECIFICATION

(First Revision)

1 SCOPE

1.1 This standard prescribes the requirements, methods of sampling and test for rubber microcellular sheet for making cut soles and heels produced by moulding process from general purpose elastomers and intended for use in footwear.

2 REFERENCES

IS No.	*Title*
1070 : 1992	Reagent grade water — Specification (*third revision*)
1638 : 1969	Specification for sizes and fittings for footwear
2050 : 1991	Glossary of terms relating to footwear (*first revision*)
4905 : 1968	Methods for random sampling

3 TERMINOLOGY

3.1 For the purpose of this standard, the definitions given in IS 2050 : 1991 and the following shall apply.

3.1.1 *Cell* — A single small cavity surrounded partially or completely by its walls.

3.1.2 *Collapse* — Inadvertent densification of cellular material during manufacture resulting from breakdown of cell structure.

3.1.3 *Skin* — A relatively dense layer at the surface of cellular material.

3.1.4 *Shrinkage* — Inadvertent dimensional decrease of cellular material without breakdown of cell structure.

3.1.5 *Void* — A cavity unintentionally formed in cellular material and substantially larger than the characteristic individual cells.

4 REQUIREMENTS

4.1 Material

The rubber used shall be compounded from natural or synthetic rubbers or their combination.

4.1.1 The rubber shall be vulcanized and it shall be homogeneous and free from sulphur bloom. The surface shall be free from blisters, cavities, collapses and blemishes. All cured spew and moulding flashes shall be trimmed from the rubber so as to have clean edges. The surface shall have reasonably good finish.

NOTE — The sheet shall be composed of mostly closed cells, but a few small open cells may be allowed, unless it forms a cavity. To limit such open cells, water absorption characteristic has been specified (*see* 4.1.3).

4.1.2 The colour and design on the surfaces of the sheets or components shall be as agreed to between the purchaser and the manufacturer.

4.1.3 The material shall also comply with the physical requirements given in Table 1.

4.2 Size and Thickness

The thickness of the material shall be as agreed to between the purchaser and the manufacturer but shall not be less than 5 mm. The size of the cut soles and heels shall be according to IS 1638 : 1969. The tolerance on agreed thickness shall be ±0·5 mm.

5 MARKING

5.1 Each sole and heel or the sheet shall be marked with the following details:

a) Name of manufacturer or recognized trade-mark,

b) Size of the footwear for which it is intended,

c) Thickness of the sheet,

d) Batch No., and

e) Date of post curing.

6 PACKING

6.1 The material shall be packed as agreed to between the purchaser and the manufacturer.

6.1.1 In case of cut components, each package shall contain soles and heels of one size only.

7 SAMPLING AND CRITERIA FOR CONFORMITY

7.1 For the purpose of ascertaining the conformity of material to this standard, the scale of sampling and criteria for conformity shall be as prescribed in Annex J.

Table 1 Physical Requirements for Rubber Microcellular Sheet for Soles and Heels

(*Clauses* 4.1.3 *and* 8.3)

Sl No.	Characteristic	Requirement	Method of Test, Ref to Annex	Method of Test, Ref to IS
(1)	(2)	(3)	(4)	(5)
i)	Relative density	0·60 to 0·70	A	—
ii)	Hardness, Shore A durometer (skin hardness), *Min*	65	B	—
iii)	Change in hardness after ageing at 100 ± 1°C for 24 hours	$^{+5}_{-0}$	C	—
iv)	Compression set at constant stress, percent, *Max*	12·0	D	—
v)	Split tear strength, kg, *Min*	7·0	E	—
vi)	Room temperature shrinkage at 27 ± 2°C for 2 weeks, percent, *Max*	1·5	F	—
vii)	Heat shrinkage test at 100 ± 1°C for 1 hour, *Max*[1)]	2·0	G	—
viii)	Water absorption, percent by mass, *Max*	1·5	H	—
ix)	Flexing resistance			
	a) Number of cycles for initial crack, *Min*	50 000		3400 (Part 6) : 1974
	b) Cut growth at the end of 1 00 000 cycles, in percent, *Max*	600		

[1)] Applicable for routine tests only.

8 TEST METHODS

8.1 Unless otherwise agreed to between the purchaser and the manufacturer, all tests shall be carried out within 3 months from the date of receipt of the material by the purchaser.

8.2 Test pieces for physical tests shall be prepared, where possible, after removing the skin from both sides of the sample selected in accordance with **8.1** except in the case of small soles and heels, when suitable sheets of the material of the same composition, density and vulcanized under identical conditions as the article shall be provided by the manufacturer.

8.3 All physical tests shall be carried out as specified in col 4 and 5 of Table 1.

ANNEX A

[*Table* 1, *Sl No.* (i)]

METHOD OF TEST FOR DETERMINATION OF RELATIVE DENSITY

A-1 TEST PIECE

A-1.1 Cut from the sample vulcanized and post cured sheets/soles test piece 50 mm × 50 mm.

A-2 PROCEDURE

A-2.1 Condition the test piece at an atmosphere of 65 ± 5 percent relative humidity and a temperature of 27 ± 2°C for at least 24 hours prior to testing. Condition at least three such test pieces.

A-3 CALCULATION

A-3.1 Calculate the relative density as follows:

$$\text{Relative density} = \frac{M}{L \times B \times T}$$

where

M = mass of the test piece in g after conditioning,

L = length of the test piece in mm after conditioning,

B = breadth of the test piece in mm after conditioning, and

T = average thickness of the test piece in mm at three different places after conditioning.

ANNEX B

[*Table* 1, *Sl No.* (ii)]

METHOD OF MEASUREMENT OF HARDNESS USING SHORE A DUROMETER

B-1 TEST PIECE

B-1.1 Cut from samples test pieces 50 mm × 50 mm by means of knife from sheets/soles.

B-2 CONDITIONING OF TEST PIECES

B-2.1 Condition test pieces and Shore A durometer at 65 ± 5 percent relative humidity at 27 ± 2°C for 24 h prior to testing.

B-3 CALIBRATION OF INSTRUMENT

B-3.1 The makers of the instrument provide precalibrated spring force and instructions for the check and testing of these instruments. These instructions should be followed. If any deviation observed, the instrument should be corrected before use (alternatively precalibrated vulcanized natural rubber disc of various hardness may be used for calibration wherever possible).

B-4 NUMBER OF TESTS

B-4.1 Carry out test on at least 3 test pieces.

B-5 PROCEDURE

B-5.1 Place the test piece firmly on a rigid surface with sheet/sole side at the top. Choose a portion of design which is smooth and plain of minimum 36 mm^2 area and the centre is about 12 to 13 mm from the nearest edge. The contact area shall nevertheless be as large as possible. Place the indentor normal to the rubber surface and press the instrument evenly without shock on to the rubber with just sufficient force to ensure complete contact of the foot (and bearing plate) with rubber. The pressure shall be applied slowly and the maximum pressure shall be applied within 3 to 4 seconds (count 1 to 5). Take the maximum reading immediately after the foot contacts with rubber. Take two such readings of each test piece and average of three test pieces.

B-6 RESULT

B-6.1 Express result directly in Shore A durometer.

ANNEX C

[*Table* 1, *Sl No.* (iii)]

METHOD OF DETERMINATION OF CHANGE IN HARDNESS AFTER AGEING AT 100±1°C FOR 24 HOURS

C-1 TEST PIECE

C-1.1 Cut from samples test pieces 50 mm × 50 mm by means of a knife, from sheets/soles.

C-2 CONDITIONING OF TEST PIECE

C-2.1 Heat the test piece in a suitable ageing oven at 100±1°C for 3 hours. Cool it on a wooden surface for 1 hour; condition the test pieces and the durometer at 27±2°C and 65±5 percent relative humidity for at least 24 hours prior to further testing.

C-3 NUMBER OF TESTS

C-3.1 Carry out test on at least three test pieces.

C-4 PROCEDURE

C-4.1 Measure sole hardness (as R_1) by method outlined in Annex B. Take average of three readings. Keep it in an oven maintained at 100±1°C for 24 hours (keep the samples on an aluminium plate). Remove and cool the test pieces for 1 hour and condition them at 27±2°C and 65±5 percent relative humidity for 24 hours. Check final Shore hardness by method outlined in Annex B. Take average of three readings (R_2).

C-5 CALCULATION

C-5.1 Increase in hardness due to ageing $= (R_2 - R_1)$

where

R_2 = final reading of Shore A durometer, and

R_1 = initial reading of Shore A durometer.

C-6 RESULT

C-6.1 Express result in Shore A durometer.

ANNEX D

[*Table* 1, *Sl No.* (iv)]

METHOD OF TEST FOR DETERMINATION OF COMPRESSION SET AT CONSTANT STRESS

D-1 COMPRESSION SET AT CONSTANT STRESS

D-1.1 Apparatus

The compression apparatus shall consist of two parallel flat, rigid plates between which the test pieces may be compressed and the means of applying slowly a load of 140 ± 1 kg to the plates and maintaining the load for a period of at least 24 hours. Alternatively, the single loading spring may be replaced by a set to three equivalent springs placed symmetrically around the central axis.

D-1.2 Test Piece

Cut three discs of diameter 30 ± 0·2 mm of any thickness from sheets soles.

D-1.3 Procedure

Condition the test pieces at 27 ± 2°C and 65 ± 5 percent relative humidity for 24 hours. Measure the initial thickness of each test piece at the centre using the gauge with part-spherical contact. Note the arithmetic mean of the three readings as the initial thickness. Place the three test pieces symmetrically between the parallel plates of the compression apparatus and subject to a compression load of 140 ± 1 kg for 24 hours. Then release the load, remove the test pieces and allow to recover. After one hour remeasure the thickness and note the arithmetic mean as the final thickness.

D-1.4 Expression of Results

The compression set is the difference between the original thickness of the test piece and that after recovery expressed as a percentage of the initial thickness.

$$\text{Compression set, percent} = \frac{t_0 - t_1}{t_0} \times 100$$

where

t_0 = the initial thickness in mm, and

t_1 = the final thickness in mm.

ANNEX E

[*Table* 1, *Sl No.* (v)]

METHOD OF TEST FOR DETERMINATION OF SPLIT TEAR STRENGTH

E-1 APPARATUS

E-1.1 Tensile Testing Machine

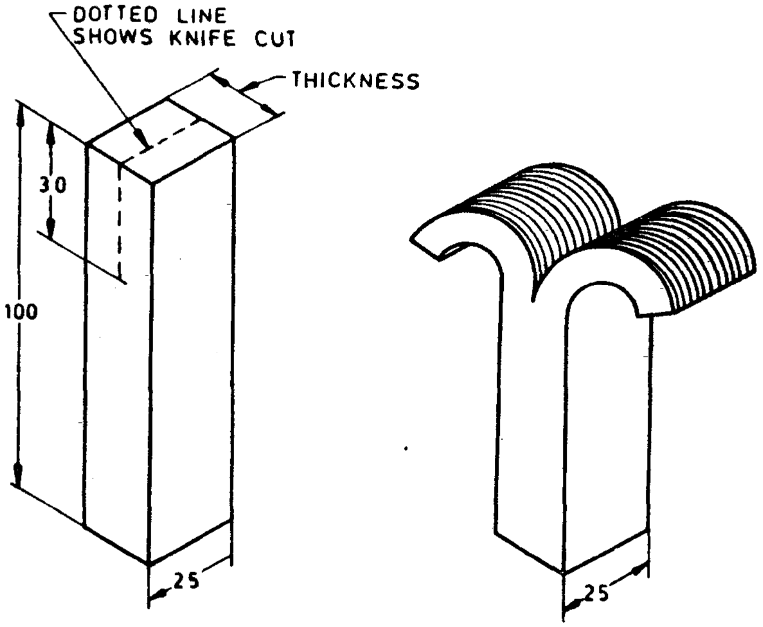
E-1.2 With rate of traverse of 75 mm per minute.

E-2 TEST PIECE

E-2.1 Cut three test pieces of 25 mm × 100 mm along and across the direction of the sheet/sole. Prepare each test piece by splitting it midway between the top and the bottom surface for a distance of 30 mm from one end and thus form two tongues at the end. The test pieces before and after knife cut have been shown in Fig. 1.

E-3 PROCEDURE

E-3.1 Clamp the tongues of the test piece in the jaws of the tensile testing machine and allow the jaws to separate at a constant rate of 75 mm per minute. Note the maximum load and record the arithmetic average of three tests in kg as the split tear strength.



1A Test Piece Before Knife Cut 1B Test Piece After Knife Cut

All dimensions in millimetres.

FIG. 1 TEST PIECE FOR SPLIT TEAR STRENGTH

ANNEX F

[*Table* 1, *Sl No.* (vi)]

METHOD OF TEST FOR DETERMINATION OF ROOM TEMPERATURE SHRINKAGE

F-1 TEST PIECE

F-1.1 Cut from samples test pieces 125 mm × 5 mm × 15 mm (*Min*) after splitting all sides of the sample from sheet/sole.

F-2 CONDITIONING OF TEST PIECE

F-2.1 Condition the test piece to an atmosphere of 65±5 percent relative density at a temperature of 27±2°C for at least 24 hours prior to testing.

F-3 NUMBER OF TESTS

F-3.1 Carry out tests on at least three test pieces.

F-4 PROCEDURE

F-4.1 Condition the test piece. Measure the length of the test piece to the nearest 0·1 mm. Keep the test piece suitably in a closed chamber maintained at 27±2°C for 2 weeks. Remove test piece from the chamber and measure the length again.

F-5 CALCULATION

F-5.1 Calculate the room temperature shrinkage as follows:

$$\text{Room temperature shrinkage, percent} = \frac{L - L_1}{L_0} \times 100$$

where

L_0 = length of test piece in mm before heating, and

L_1 = length of the test piece in mm after heating for 2 weeks.

ANNEX G

[*Table* 1, *Sl No.* (vii)]

METHOD OF TEST FOR DETERMINATION OF HEAT SHRINKAGE

G-1 TEST PIECE

G-1.1 Cut from samples test pieces 125 mm × 5 mm × 5 mm after splitting all sides of the sample from sheet/sole.

G-2 CONDITIONING OF TEST PIECE

G-2.1 Condition the test piece to an atmosphere of 65 ± 5 percent relative humidity at a temperature of 27 ± 2°C for at least 24 hours, prior to testing.

G-3 NUMBER OF TESTS

G-3.1 Carry out tests on at least three test pieces.

G-4 PROCEDURE

G-4.1 Condition the test piece. Measure the length of the test piece to the nearest 0·1 mm. Keep the test piece suitably in a heating chamber maintained at 100 ± 1°C for one hour. Remove the test piece from the heating chamber and allow to cool for 2 hours at 27 ± 2°C. Measure the length of the test piece again.

G-5 CALCULATION

G-5.1 Calculate the heat shrinkage as follows:

$$\text{Heat shrinkage, percent} = \frac{L_0 - L_1}{L_0} \times 100$$

where

L_0 = length of the test piece in mm before heating, and

L_1 = length of the test piece in mm after heating.

ANNEX H

[*Table* 1, *Sl No.* (viii)]

METHOD OF TEST FOR DETERMINATION OF WATER ABSORPTION

H-1 TEST PIECE

H-1.1 Cut from samples test pieces 5 mm × 5 mm × 5 mm after splitting all sides of the sample to remove the skin.

H-2 CONDITIONING OF TEST PIECE

Condition the test pieces to an atmosphere of 65 ± 5 percent relative humidity at a temperature of 27 ± 2°C for at least 24 hours prior to testing.

H-3 NUMBER OF TESTS

Carry out tests on at least three test pieces.

H-4 PROCEDURE

Condition the test pieces. Weigh to the nearest 0·5 mg and immerse for a period of 24 hours in distilled water (*see* IS 1070 : 1992) at 27 ± 2°C. Remove from water, wipe dry the exposed surfaces with blotting paper. Re-weigh the test pieces to the nearest 0·5 mg within two minutes of the removal of the test pieces from water.

H-5 CALCULATION

H-5.1 Calculate the water absorption as follows:

$$\text{Water absorption, percent by mass} = \frac{M_1 - M_0}{M_0} \times 100$$

where

M_1 = mass in g of the test piece after immersion in water; and

M_0 = mass in g of the test piece before immersion in water.

ANNEX J

(*Clause* 6.1)

SCALE OF SAMPLING AND CRITERIA FOR CONFORMITY

J-1 SCALE OF SAMPLING

J-1.1 Lot

In any consignment, all the micro-cellular rubber sheets for soles and heels supplied at one time and manufactured in one batch shall constitute a lot.

J-1.1.1 Sample shall be taken from the lot for ascertaining the conformity to this specification and shall be according to Table 2.

Table 2 Number of Microcellular Rubber Sheets to be Sampled

Lot Size (1)	Sample Size (2)	Acceptance Number (3)
Up to 50	2	0
51 to 100	3	0
101 to 150	5	0
151 to 300	8	1
301 and above	13	2

J-1.1.2 Sample shall be selected from the lot at random and in order to ensure the randomness of selection, procedure given in IS 4905 : 1968 be followed.

J-2 CRITERIA FOR CONFORMITY

J-2.1 All the micro-cellular rubber sheets selected in the sample shall be subjected to visual examination for the material, size and thickness. The lot shall be considered to be in conformity with these requirements if none of the microcellular rubber sheet contains any defect.

J-2.2 The sample sheets shall be subjected to physical test given in Table 1. If any sheet fails to satisfy any of the physical requirements given in Table 1 it shall be declared as defective. The lot shall be declared as conforming to this specification if the number of defective sheets in the sampling does not exceed the corresponding acceptance number given in col 3 of Table 2.

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